REMARKS

Applicants have amended their specification in the paragraph bridging pages 29 and 30, to delete the description that the mixing ratio of expanded graphite/resin falls "more preferably within the range of from 95/5 to 30/70 (by weight)". In view of this amendment to the specification, it is respectfully submitted that the objections to the specification in Items 4i. and ii. are moot.

The objection to the Abstract as set forth in Item 3 on page 3 of the Office Action mailed February 26, 2008, is noted. Applicants have amended their Abstract so as to be less than 150 words. It is respectfully submitted that the Abstract as presently amended satisfies applicable rules for abstracts in U.S. patent applications.

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended each of claims 1, 4 and 6 to incorporate therein the subject matter of claim 7; and have amended each of claims 1, 4, 6 and 8 to incorporate therein the subject matter of claim 9, additionally reciting that the separator has openings within the flat portion. In light of these amendments to claims 1, 4, 6 and 8, Applicants have cancelled claims 7 and 9 without prejudice or disclaimer. In addition, Applicants have amended the claims to recite that the bending strain, compressive modulus and Shore hardness are measured "at the flat portion". Note, for example, the paragraph bridging pages 16 and 17 of Applicants' specification, describing that the separator has openings within the flat portion. See also, for example, the paragraph bridging pages 40 and 41 of Applicants' specification, disclosing measurements taken at the flat portion.

In addition, Applicants have deleted multiple dependency from claims 3, 10 and 12, and have amended claim 14 to be dependent on any one of claims 4, 6 and 8. Furthermore, Applicants have amended claim 11 to be dependent on claim 8, reciting that the graphite is a pulverized powder of an expanded graphite sheet; and Applicants have cancelled claims 13 and 15 without prejudice or disclaimer.

Moreover, Applicants are adding new claims 16-21 to the application. Claims 16 and 17, each dependent on claim 1, further define the bending strain at the flat portion at break; claims 18 and 19, each dependent on claim 4, further define the compressive modulus at the flat portion; and claims 20 and 21, each dependent on claim 6, further define the Shore hardness at the flat portion, consistent with descriptions on pages 9 and 10 of Applicants' specification.

The comments by the Examiner in Item 1 on page 2 of the Office Action mailed February 26, 2008, are noted. It is respectfully submitted that JP 2000-182630 and JP 2001-189159 were cited in the International Search Report for International (PCT) Application No. PCT/JP02/13453, of which the above-identified application is a National Stage Application filed under 35 USC 371, and that such International Search Report was submitted upon originally filing the above-identified application. It is respectfully submitted that such International Search Report provides the necessary "concise explanation". See Manual of Patent Examining Procedure (MPEP) 609.04(a), III. (Concise Explanation of Relevance for Non-English Language Information), in the paragraph bridging pages 600-153 and 600-154. Reconsideration and indication of consideration of JP 2000-182630 and JP 2001-189159, upon further examination of the above-identified application, are respectfully requested.

With respect to the contention by the Examiner in the second paragraph of Item 1 on page 2 of the Office Action mailed February 26, 2008, as indicated in the Information Disclosure Statement filed October 27, 2004 the list therein corrects the document number for JP 2000-348740. While no new reference is listed therein, in view of the correct document number thereon, it is respectfully requested that the Examiner at least indicate consideration of the proper document number, for listing in the patent.

The double patenting rejection set forth in Item 2 on pages 2 and 3 of the Office Action mailed February 26, 2008, is noted. As can be appreciated, Applicants have incorporated at least subject matter of claim 9 into claim 8. As, inter alia, claim 9 was not rejected on the ground of nonstatutory obviousness-type double patenting (note that objected-to claims 10-12 and 15 were so rejected), it is respectfully submitted that the obviousness-type double patenting rejection is moot.

In any event, the fuel-cell separator claimed in U.S. Patent No. 6,794,078 is noted. The separator claimed therein includes (1) a cured phenolic resin resulting from specified processing of a specific phenolic resin, and (2a) an expanded-graphite powder, or (2b) the expanded graphite powder and a carbon fiber. Claim 7 of No. 6,794,078 recites that the separator has a shape of a ribbed-plate formed by monobloc-molding a plate and ribs, and claim 16 of the patent recites a bending strength of 30 MPa or more (as can be appreciated, such bending strength is different from the bending strain of the present claims). Claims 24 and 25 of No. 6,794,078 recite a residual carbolic acid concentration and residual sulfuric acid concentration of the separator.

It is respectfully submitted that the subject matter claimed in No. 6,794,078 would have neither taught nor would have suggested the presently claimed

separator, including wherein the separator has a rib portion, a flat portion and openings within the flat portion, or total concentration of sodium, potassium, iron, nickel and magnesium released into the soaking water, and concentration of sulfur released into the soaking water, as in the present claims.

As to amounts released into the water as in the present claims, it is emphasized that those amounts are determined after soaking the separator with water under prescribed conditions. As can be appreciated, the separators are exposed to water once they have been assembled into a fuel cell, and if impurities are released into the water, cell performance would be disadvantageously degraded. In view of this, claim 8 recites properties of the separator (total concentration of sodium, potassium, iron, nickel and magnesium, and concentration of sulfur, released into the soaking water). Amount of metals or sulfur eluted into the water would vary depending on the impurities originally contained in the materials for the separator, as well as various other factors such as curing reaction, including progress thereof, compactness in assembling the separators (which can change the contact area of the separators with water), method of producing the graphite and resin (which can accompany impurities during the production), etc. Whether materials and methods disclosed/claimed previously appear similar to those in the present invention would not have led to the conclusion that the resulting product showed the same properties, in view of other factors discussed in the foregoing.

The contention by the Examiner in the paragraph bridging pages 2 and 3 of the Office Action mailed February 26, 2008, that the process limitation of soaking the separator in water is a process limitation not given patentable weight, is noted. It must be emphasized that the recitation as to maximum amount of release of the materials recited in claim 8 is a property of the separator, not a method. Contrary to

the conclusion by the Examiner, and noting various factors contributing to the amount of the specified materials released, it is respectfully submitted that the claimed subject matter in No. 6,794,078 would have neither disclosed nor would have suggested the presently claimed subject matter as in claim 8, and advantages due thereto (that is, wherein degradation of cell performance is avoided).

The objection to claims 3, 7 and 9-15 in Item 6 on page 4 of the Office Action mailed February 26, 2008, is noted. It is respectfully submitted that in view of present amendments to the claims, whereby claims 3 and 10-12 are now single-dependent claims, rejection of claims as being in improper multiple dependent form is moot.

Applicants respectfully submit that all of the claims presented for consideration patentably distinguish over the teachings of the reference applied by the Examiner in rejecting claims in the Office Action mailed February 26, 2008, that is, the teachings of U.S. Patent Application Publication No. 2002/0107318 to Yamada, et al., under the provisions of 35 USC 102 and 35 USC 103.

It is respectfully submitted that Yamada, et al. would have neither taught nor would have suggested such a separator for a fuel cell as in the present claims, the separator having a rib portion, a flat portion and openings within the flat portion, and wherein the separator has a bending strain at the flat portion at break of 0.5% or more, as in claim 1; and/or a compressive modulus at the flat portion of 20 GPa or less, as in claims 2 and 4; and/or having a Shore hardness at the flat portion from 20-50 , as in claims 3, 5 and 6. Note, further, more specific definition of the bending strain, compressive modulus and Shore hardness, in claims 16-21.

Furthermore, it is respectfully submitted that Yamada, et al. would have neither taught nor would have suggested such a separator for a fuel cell as in the

present claims, made of a molded body and wherein the separator has a rib portion, a flat portion and openings within the flat portion, and wherein, after soaking the separator at 80°C for 100 hours and 30 times the volume of the molded body of water, total concentration of sodium, potassium, iron, nickel and magnesium released into the soaking water is 20 ppm or less, and concentration of sulfur released into the soaking water is 30 ppm or less. See claim 8.

In addition, it is respectfully submitted that the teachings of the applied reference would have neither disclosed nor would have suggested such a separator as in the present claims, having features as discussed previously in connection with claim 8, and, additionally, wherein the graphite is expanded graphite (see claim 10), or is a pulverized powder of an expanded graphite sheet (see claim 11); or wherein the resin is a thermosetting resin (see claim 12).

Furthermore, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested a fuel cell comprising the separator as set forth in any one of claims 4, 6 and 8. See claim 14.

The present invention is directed to a separator for a fuel cell, particularly suitable for a polymer electrolyte fuel cell, and to a fuel cell using such separator.

As described on page 5 of Applicants' specification, a graphite powder/resin molded material as disclosed in International Publication No. WO 97/02612 is made by means of a thermocompression molding method, injection molding method and like from a source material composed of a mixture of carbon powder, graphite powder, a thermosetting resin, a thermoplastic resin and the like.

However, and as described in the paragraph bridging pages 5 and 6 of Applicants' specification, a separator obtained from a graphite powder/resin molded material as previously proposed has a structure in which graphite powder is bonded

with the resin, so that water tends to penetrate into the voids between the graphite powder particles and the resin during operation, and the surface of the separator tends to be increased. In addition, disadvantageously components including metal impurities elute from the separator; and a fuel cell that uses such separator tends to be deteriorated in cell properties when used over a period of time, and hence there has been a problem involving reliability and durability.

In addition, problems arise when the separators are assembled in a stack, the separators each having a large thickness variation. Such variation causes large local distortions, and tends to increase the possibility of fracture.

Against this background, Applicants provide separators which can be used over a long period of time with good reliability, and which avoid breaking of the separators.

According to one aspect of the present invention, Applicants have found that the bending strain at the flat portion at break, rather than bending strength, is an important parameter. As described in the paragraph bridging pages 9 and 10 of Applicants' specification, when the separators are assembled in a stack, the separators are strongly compressed, so that to prevent breaking of the separators in this case, the bending strain at the flat portion at break is important. Additionally, the bending strain at the flat portion at break becomes important for improving adhesivity of the separators and the performance as a fuel cell when a solid polymer film or a carbon paper sheet is sandwiched in each of the separators.

In addition, Applicants have further found that even if the bending strain at the flat portion at break is less than 0.5%, the objective of the present invention can be achieved when the compressive modulus and/or Shore hardness at the flat portion are within ranges as set forth in the present claims. Note the paragraph bridging

pages 10 and 11 of Applicants' specification. See also the sole full paragraph on page 11 of Applicants' specification.

Applicants have still further found that irrespective as to whether the separator has the bending strain, compressive modulus and Shore hardness at the flat portion as in the present claims, the molded body of graphite and resin having released the specified amounts of materials as in claim 8 avoids degradation in performance when operated over a long period of time. Note, for example, the paragraph bridging pages 13 and 14 of Applicants' specification.

It is emphasized that the recited total concentration of sodium, potassium, iron, nickel and magnesium released into the soaking water, and concentration of sulfur released into the soaking water, are those determined after soaking the separator with water under prescribed conditions. These constitute a property of the separator, the property being measured under specific procedures. As will be shown in the following, it is respectfully submitted that Yamada, et al. would have neither disclosed nor would have suggested controlling the specified properties at the flat portion of the separator for fuel cell to fall within the specific range, or amounts of specific impurities that are released by the separator, as in the present claims, or advantages thereof as discussed previously.

Yamada, et al. discloses a resin composition, and a fuel cell separator and sealing material each comprising the resin composition. The resin composition is disclosed most generally in paragraph [0012] on page 1, and includes specific amounts of a resin composed of a specific amount of a polyimide resin, and optionally an epoxy resin, and specific amounts of at least one filler selected from the group consisting of graphite, keljen black, acetylene black, furnace carbon black and thermal carbon black. Note also paragraph [0015] bridging pages 1 and 2 of

Yamada, et al. Note also paragraph [0037] on page 4; and paragraph [0053] on page 5, the latter paragraph disclosing use of the resin composition as a material for a separator.

It is respectfully submitted that Yamada, et al. would have neither disclosed nor would have suggested such separator for a fuel cell having the rib portion, flat portion and openings within the flat portion, as in the present claims.

Moreover, it is respectfully submitted that Yamada, et al. would have neither taught nor would have suggested the bending strain at the flat portion at break, compressive modulus and/or Shore hardness at the flat portion, of the separator having the rib portion, flat portion and openings within the flat portion, and advantages thereof as discussed in the foregoing.

In this regard, the contention by the Examiner that the separator of Yamada, et al. would have the same properties, such as the specified bending strain at break, compressive modulus and Shore hardness, as it is materially the same as the separator of the above-identified application and was made by the same process, is respectfully traversed. As stated previously, clearly the structures of the separators are different. Moreover, noting the broad teaching in Yamada, et al., it is respectfully submitted that from the teachings thereof the bending strain at break, compressive modulus and Shore hardness, at the flat portion, falling within the instantly recited ranges, would not have been inherent, that is, that the necessary and only reasonable result from the teachings of Yamada, et al. as a whole would not fall within the scope of the present claims.

Similarly, it is respectfully submitted that, in connection with claim 8, Yamada, et al. would have neither taught nor would have suggested the specific shape of the separator as in the present claims, or maximum concentration of specific

components released therefrom, and advantages thereof. That is, contrary to the conclusion by the Examiner, the Examiner has not established inherency in the separator of Yamada, et al.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims remaining in the above-identified application are respectfully requested.

To the extent necessary, Applicants hereby petition for an extension of time under 37 CFR 1.136. Kindly charge any shortage of fees due in connection with the filing of this paper, including any extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Account No. 01-2135 (case 500.43947X00), and please credit any overpayments to such Deposit Account.

Respectfully submitted,

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